



Docket No. 50439  
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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

APPLICANT: Barstad et al.

SERIAL NO.: 09/605,442 GROUP: 1742

FILED: June 28, 2000 EXAMINER: H. Wilkins III

FOR: ELECTROLYTIC COPPER ELECTROPLATING COMPOSITIONS

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Commissioner of Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

**APPEAL BRIEF**

Applicant respectfully appeals the decision of the Examiner, dated August 15, 2006, finally rejecting claims 124-132, 134-137, 141-154 and 158-167.

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<b>Related Proceedings Appendix D:</b>	(no materials)

**I. REAL PARTY IN INTEREST**

The real party in interest is Shipley Company LLC of Marlborough, Massachusetts.

**II. RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences known to Appellant or Appellant's representatives that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending Appeal.

**III. STATUS OF THE CLAIMS**

Claims 1-167 have been presented in this application.

Claims 1-123, 133, 138-140, and 155-157 have been cancelled.

Claims 124-132, 134-137, 141-154 and 158-167 have been finally rejected and presently are on appeal (see the attached Appendix A).

**IV. STATUS OF THE AMENDMENTS (AFTER FINAL REJECTION)**

No amendments after final rejection have been presented.

## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

Appellant's claimed invention is directed to methods for electrolytically depositing copper onto semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, a suppressor agent, and one or more brightener compounds having a molecular weight of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition, and wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide. See independent claim 124 at Claims Appendix A.

Appellant's methods are particularly useful for filling microvias and trenches of microelectronic wafer substrates as required by current and anticipated semiconductor fabrication requirements. See application at page 4, lines 10-16. The methods of the invention include use of a copper plating composition that includes high brightener component concentrations, such as at least 1.5 mg per liter of plating solution. See page 4, lines 18-19 of the application.

Methods of the invention can reliably plate copper deposits that are essentially or completely free of voids, inclusions or other plating imperfections. See application at page 4, lines 10-16.

### ***Appellant's independent claims 124, 137, 154 and 160***

Appellant has four independent claims on appeal: claims 124, 137, 154 and 160. Those claims read as follows:

*Claim 124.* A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, a suppressor agent, and one or more brightener compounds having a molecular weight of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

*Claim 137.* A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula R'-S-R-SO<sub>3</sub>X where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heterocyclic; and X is a counter ion,

wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

*Claim 154.* A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, electrolyte, suppressor agent, and one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula R'-S-R-SO<sub>3</sub>X where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heterocyclic; and X is a counter ion,

wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

*Claim 160.* A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds that comprise bis-sulfonopropyl disulfide and the one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

*All the pending claims call for bis-sulfonopropyl disulfide*

A preferred brightener agent of Appellant's is bis-sulfonopropyl disulfide. See page 10, lines 11-12 of the application. **All the pending claims call for bis-sulfonopropyl disulfide.**

***Demonstrated effective plating of microelectronic wafer substrates***

Such effects are specifically demonstrated in the comparative examples of the application as filed. In this regard, attention is also directed to the comparative results detailed at Examples 2 and 3 of the application. In Example 2, using a copper electroplating composition of the invention, semiconductor microvias having 200 nm diameters and 7:1 aspect ratios were filled with copper deposits having no defects as determined by focused beam examination. In comparative Example 3, a copper electroplating composition having a brightener concentration of 0.35 mg/l produced a copper deposit with defects in microvias having diameter of 200 nm and 4:1 aspect ratio. See pages 16-17 of the application.

**Additional use of suppressor agent**

Appellant's preferred methods include use of a suppressor agent such as a polyether. Appellant has found that use of a suppressor agent in combination with elevated brightener concentrations can result in effective "bottom-fill" copper plating of a microvia or other aperture without defects such as inclusions or voids. See page 5, lines 12-15 of the application. Independent claims 124 and 154 each call for a suppressor agent.

In preferred methods, the brightener concentration is maintained at such high concentrations throughout the entire or at least substantial portion of a plating cycle. Such maintenance of brightener concentrations entails regular addition of brightener during a plating cycle as the brightener component plates out. See page 5, lines 4-10 of the application.

**VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

Two issues are on appeal:

1. Whether claims 124-132, 134-137, 141-154 and 158-167 are unpatentable under 35 U.S.C. §103 over Beach et al. (U.S. Patent 4,334,966) in view of Bernards et al. (U.S. Patent 5,051,154) and further in view of Dubin et al. (U.S. Patent 5,972,192).
2. Whether claims 124-132, 134-137, 141-154 and 158-167 are unpatentable under 35 U.S.C. §103 over Dahms et al. (U.S. Patent 3,778,357) in view of Dubin et al. (U.S. Patent 5,972,192) and further in view of Bernards et al. (U.S. Patent 5,051,154).

## VII. ARGUMENT

1. **Rejection of claims 124-132, 134-137, 141-154 and 158-167 under 35 U.S.C. §103 over Beach et al. (U.S. Patent 4,334,966) in view of Bernards et al. (U.S. Patent 5,051,154) and further in view of Dubin et al. (U.S. Patent 5,972,192).**

(a) *The Examiner's rejection:*

It is acknowledged that none of three cited documents alone renders obvious Appellant's claimed invention.

The position is nevertheless taken that it would have been obvious to carefully select and combine isolated features of Beach et al. (U.S. Patent 4,334,966), Bernards et al. (U.S. Patent 5,051,154) and Dubin et al. (U.S. Patent 5,972,192) and that careful combination would have rendered Appellant's claimed invention obvious.

As specifically admitted at page 2 of the Final Office Action dated August 15, 2006:

"Beach et al fails to teach (1) that the brightener included bis-sulfonopropyl disulfide and (2) plating on a semiconductor substrate."

However, the position is taken as follows as stated at page 3 of the Final Office Action dated August 15, 2006:

Bernards et al teach (see col 6, lines 29-37) using a bis-sulfonopropyl disulfide as a brightener at an amount up to 3.0 ppm by weight of solution (which converts to 3.0 mg/L).

Therefore, it would have been obvious to one of ordinary skill in the art to have used the bis-sulfonopropyl disulfide compound of Bernards et al. as the brightener of Dahms et al because the bis-sulfonopropyl disulfide is a conventional brightener in copper electroplating that improves throwing power (see col. 5, line 49 to col 6, line 13 esp col. 6, lines 5-10) of the electroplating, thus making plating in vias and trenches more even.

Dubin et al. teach (see col. 1lines 5-40) electroplating copper onto a dielectric silicon layer of a microchip wafer with microvias and trenches.

Therefore, it would have been obvious to one of ordinary skill in the art to have applied the copper electroplating method of Beach et al to the silicon microchip wafer with microvias and trenches of Dubin et al because the method of Beach et al has good electroplating properties.

(b) *Appellant's position:*

A. *No incentive would have existed to combine the cited documents as proposed by the final rejection.*

The skilled would not have had any incentive to carefully combine selected aspects of the cited documents as proposed by the instant rejection.

Thus, the primary citation of Beach et al. is directed to plating *gravure rolls* (a type of printed plate). Thus, the primary citation is outside the electronics industry. Clearly, the skilled worker would not look to gravure rolls for materials to plate much different semiconductor wafers.

Bernards is also quite distinct and pertains to plating on *printed circuit boards*.

Persons skilled in the art recognize that plating on copper on a microchip wafer is considerably more difficult, and possess unique issues, relative to plating copper on a printed circuit board as reported by Bernards et al. or gravure plates as reported in Beach et al.<sup>1</sup>

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<sup>1</sup> It is well-documented that persons skilled in the art recognize that plating copper on a microelectronic wafer is considerably more difficult, and poses unique issues relative to plating copper on a printed circuit board. This is made clear in, for instance, U.S. Patent 6,290,833. Thus, at column 2, lines 35-39 of that patent, the following is reported (bold emphasis added):

Despite the advantageous properties of copper, it has not been as widely used as an interconnect material as one would expect. This is due, at least in part, to the difficulty of depositing copper metallization and, further, due to the need for the presence of barrier layer materials.

Similarly, U.S. Patent 6,297,154 reports the following at column 2, lines 33-41 (bold emphasis added):

As noted in U.S. Pat. No. 5,627,102 to Shinriki et al., one problem associated with the formation of metal interconnects in that voids form in the metal filling of the recess. Such faulty fill-up leads to a failure to establish a sound electrical contact. The problem with faulty fill-up increases with increasing aspect ratio. Consequently, as the width of the recess decreases, the problems of faulty fill-up increase.

U.S. Patent 6,171,960 reports the following at column 1, lines 10-27 (bold emphasis added):

The fabrication of deep submicron ultra large scale integrated (ULSI) circuits requires long interconnects having small contacts and small cross-sections. To achieve the above objectives, the preferred interconnect material is copper. Copper provides a number of advantages for wiring applications including low resistivity and a high melting point.

At present, aluminum is the material used in fabricating interconnects on most integrated circuits. This invention seeks to replace the aluminum with copper in the fabrication of advanced circuits and ultra-fast logic devices.

**Many problems, however, are encountered in fabricating circuit interconnects with copper.** Some of the major difficulties include: (a) copper oxidizes easily at low temperatures; (2) copper has poor adhesion to substrates; (3) copper diffuses into silicon dioxide and other dielectric material used in micro-circuitry; and (4) copper requires a high temperature for patterning by reactive ion etching.

Thus, the art recognized that unique issues were associated with plating copper on semiconductor substrates. Accordingly, the skilled worker would not have considered it at all obvious to plate semiconductor microchip wafers with a composition reported for plating on printed circuit boards or gravure rolls as proposed by the instant rejection.

Clearly, the skilled worker would not have had any expectation of the excellent performance results achieved by use of the electroplating compositions of the invention for plating on semiconductor microchip wafers as demonstrated in the present application.

Indeed, Appellant has explained such distinction (as outlined in note 1, *supra*) in prior responses, and prior rejections based on reasoning similar to the instant rejection have been withdrawn in view of such explanation.<sup>2</sup>

The Dubin document adds little and reports a certain pulse-plating sequence. No incentive would have existed to modify the Dubin system based on the primary citation of Beach (which is specifically directed to gravure rolls) or Bernards (printed circuit boards). Nor do Beach or Bernards provide any suggestion that the reported compositions could be employed in a pulse-plating procedure.

*B. Comparative data of record rebuts any prima facie case under Section 103 that may be contended to exist.*

As discussed above, Examples 2 and 3 of the application detail comparative results which clearly rebut any prima facie case that may be contended to exist.

In those comparative examples, the brightener agent was bis-sodium-sulfonopropyl-disulfide. As discussed above, all the claims on appeal call for bis-sodium-sulfonopropyl-disulfide. In Example 2, using a copper electroplating composition of the invention, semiconductor microvias having 200 nm diameters and 7:1 aspect ratios were filled with copper

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<sup>2</sup> In particular, attention is directed to paper 16, Office Action dated January 24, 2003 at page 4, wherein the USPTO expressly withdrew rejections under 35 U.S.C. 103 in view of the same comments and evidence as set forth at note 1, *supra*. Specifically, the USPTO stated at page 4 of that paper 16

The 35 USC §103 rejections as set forth in the previous Office action have been withdrawn in view of the argument submitted by Applicant on November 19, 2002.

Appellant submits that the USPTO should adopt now the same position the USPTO *has already adopted* in this case.

deposits having no defects as determined by focused beam examination. In comparative Example 3, a copper electroplating composition having a brightener concentration of 0.35 mg/l produced a copper deposit with defects in microvias having diameter of 200 nm and 4:1 aspect ratio. See pages 16-17 of the application.

These results clearly support patentability of all the pending claims.

2. **Rejection of claims 124-132, 134-137, 141-154 and 158-167 under 35 U.S.C. §103 over Dahms et al. (U.S. Patent 3,778,357) in view of Dubin et al. (U.S. Patent 5,972,192) and further in view of Bernards et al.**

(a) *The rejection:*

It is again acknowledged that none of three cited documents alone renders obvious Appellant's claimed invention.

The position is nevertheless taken that it would have been obvious to carefully select and combine isolated features of Dahms et al. (U.S. Patent 3,778,357), Dubin et al. (U.S. Patent 5,972,192) and Bernards et al. (U.S. Patent 5,972,192) and that careful combination would have rendered Appellant's claimed invention obvious.

As specifically admitted at page 4 of the Final Office Action dated August 15, 2006:

"Dahms et al. do not teach using (1) plating on a semiconductor wafer substrate and (2) a sulfonopropyl disulfide as a brightener."

However, the position is taken as follows as stated at page 4-5 of the Final Office Action dated August 15, 2006:

Dubin et al teach (col. 1, lines 5-40) electroplating copper onto a dielectric silicon layer of a microchip wafer with microvias and trenches.

Therefore, it would have been obvious to one of ordinary skill in the art to have applied the copper electroplating method of Beach et al. to the silicon microchip wafer with microvias and trenches of Dubin et al because the method of Beach et al. has good electroplating characteristics.

Bernards et al teach (see paragraph spanning cols. 2 and 3 and col. 4, lines 31-45) adding a polyether surfactant to a copper electroplating solution to improve throwing power of the solution (i.e.-improved even plating in high aspect ratio through holes (see discussion at col. 1, line 29 to col. 2, line 35).

Therefore, it would have been obvious to one of ordinary skill in the art to have added the polyether surfactant as a suppressor agent to the prior art copper plating solutions because Bernards et al teach that the polyether surfactant has the ability to improve even plating in high aspect ratio features.

Bernards et al. teach (see col. 6, lines 29-37) using a bis-sulfonopropyl disulfide as a brightener at an amount up to 3.0 ppm by weight of solution (which converts to 3.0 mg/L)/

Therefore, it would have been obvious to one of ordinary skill in the art to have used the bisulfopropyl disulfide compound of Bernards et al as the brightener of Dahms et al because the bisulfopropyl disulfide is a conventional brightener in copper electroplating that improves throwing power (see col. 5, line 49 to col. 6, line 13, esp. col. 6, lines 5-10) of the electroplating, thus making plating in vias and trenches more even.

(b) *Appellant's position:*

A. *No incentive would have existed to combine the cited documents as proposed by the final rejection.*

The skilled would not have had any incentive to carefully combine selected aspects of the cited documents as proposed by the instant rejection.

Indeed, Dahms et al. does *not disclose any specific type of substrate for plating*. As mentioned above, the Bernards document is directed to printed circuit boards. As discussed, persons skilled in the art recognize that plating on copper on a microchip wafer is considerably more difficult, and possess unique issues, relative to plating copper on a printed circuit board. See note 1, *supra*.

Clearly, the skilled worker would not have had no incentive to so carefully combine selected aspects of Dahms et al., Dubin et al. and Bernards et al. as proposed by the instant rejection. Indeed, the priority dates of the three citations span 25 years and no report existed during that time of the proposed combination of record.

In fact, the cited documents themselves specifically *teach against* the proposed combination. For instance, Dubin et al. reports use of a pulse-plating sequence to improve plating of vias. In that pulse plating sequence, use of relatively low concentration brightener is reported. See Dubin et al. at column 8, lines 4-16. In clear distinction, Dahms reports use of certain phosphonium ion compounds for plating at high current densities. In other words, the cited documents advance different goals to resolve the stated technical difficulty; those distinct goals of each of the cited documents indicate that the skilled worker clearly would not have had any incentive to make the proposed combination.

*B. Comparative data of record rebuts any prima facie case under Section 103 that may be contended to exist.*

As discussed above, Examples 2 and 3 of the application detail comparative results which clearly rebut any prima facie case that may be contended to exist. That discussion above is specifically incorporated by reference and repeated here.

These results clearly support patentability of all the pending claims.

**3. Each of the claims on appeal is separately patentable.**

The cited documents no suggestion of other aspects of Appellant's claimed invention.

*a) Claim 125*

For instance, claim 125 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

*b) Claim 126*

Claim 126 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

*c) Claim 127*

Claim 127 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

*d) Claim 128*

Claim 128 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

*e) Claim 129*

Claim 129 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

e) *Claim 130*

Claim 130 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

f) *Claim 131*

Claim 131 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition. Indeed, it is not seen from any of the cited documents to use such high brightener concentrations.

g) *Claim 132*

Claim 132 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition. It is not seen from any of the cited documents to use such high brightener concentrations.

h) *Claim 134*

Claim 134 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the suppressor agent is a polyether. As discussed above, Appellants' have found that use of a suppressor agent in combination with a brightener agent provides particularly good results. The comparative data at Examples 2 and 3 of the application include use of a polyether suppressor agent.

i) *Claim 135*

Claim 135 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the electroplating composition comprises a halide ion source.

j) *Claim 136*

Claim 136 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 124 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

k) *Claim 141*

Claim 141 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the one or more brightener compounds have a molecular weight of about 1000 or less.

l) *Claim 142*

Claim 142 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

m) *Claim 143*

Claim 143 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

n) *Claim 144*

Claim 144 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

o) *Claim 145*

Claim 145 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener

concentration is at least about 5 mg per liter of the electroplating composition.

*p) Claim 146*

Claim 146 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

*q) Claim 147*

Claim 147 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition. It is not seen from any of the cited documents to use such high brightener concentrations.

*r) Claim 148*

Claim 148 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition. It is not seen from any of the cited documents to use such high brightener concentrations.

*s) Claim 149*

Claim 149 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition. It is not seen from any of the cited documents to use such high brightener concentrations.

*t) Claim 150*

Claim 150 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the electroplating

composition further comprises a suppressor agent. As discussed above, the comparative data at Examples 2 and 3 of the application include use of a suppressor agent. Appellant has found that use of a suppressor agent in combination with a brightener agent provides particularly good results

*u) Claim 151*

Claim 151 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 150 wherein the suppressor agent is a polyether. The comparative data at Examples 2 and 3 of the application include use of a polyether suppressor agent.

*v) Claim 152*

Claim 152 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the electroplating comprises a halide ion source.

*w) Claim 153*

Claim 153 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

*x) Claim 158*

Claim 158 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 154 wherein one or more brightener compounds have a molecular weight of about 1000 or less.

*y) Claim 159*

Claim 159 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 137 wherein the suppressor agent is

a polyether. The comparative data at Examples 2 and 3 of the application include use of a suppressor agent.

*z) Claim 161*

Claim 161 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 160 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

*aa) Claim 162*

Claim 162 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 160 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

*bb) Claim 163*

Claim 163 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 160 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

*cc) Claim 164*

Claim 164 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 160 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition. It is not seen from any of the cited documents to use such high brightener concentrations.

*dd) Claim 165*

Claim 165 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 160 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition. It is

not seen from any of the cited documents to use such high brightener concentrations.

*ee)      Claim 166*

Claim 166 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 160 wherein the electroplating composition further comprises a suppressor agent. As discussed above, the comparative data at Examples 2 and 3 of the application include use of a suppressor agent. Appellant has found that use of a suppressor agent in combination with a brightener agent provides particularly good results

*ff)      Claim 167*

Claim 167 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the method of claim 166 wherein the suppressor agent is a polyether. The comparative data at Examples 2 and 3 of the application include use of a polyether suppressor agent.

**SUMMARY**

Therefore, for the foregoing reasons, it is respectfully requested that the Board reverse the final rejection in this application.

Respectfully submitted,

Date: June 15, 2007

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## CLAIMS APPENDIX A

Claim 124. A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, a suppressor agent, and one or more brightener compounds having a molecular weight of about 1000 or less and that are present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

Claim 125. The method of claim 124 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

Claim 126. The method of claim 124 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

Claim 127. The method of claim 124 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

Claim 128. The method of claim 124 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

Claim 129. The method of claim 124 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

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Claim 130. The method of claim 124 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

Claim 131. The method of claim 124 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

Claim 132. The method of claim 124 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

Claim 134. The method of claim 124 wherein the suppressor agent is a polyether.

Claim 135. The method of claim 124 wherein the electroplating composition comprises a halide ion source.

Claim 136. The method of claim 124 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

Claim 137. A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula R'-S-R-SO<sub>3</sub>X where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heterocyclic; and X is a counter ion, wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

Claim 141. The method of claim 137 the one or more brightener compounds have a

molecular weight of about 1000 or less.

Claim 142. The method of claim 137 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

Claim 143. The method of claim 137 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

Claim 144. The method of claim 137 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

Claim 145. The method of claim 137 wherein the brightener concentration is at least about 5 mg per liter of the electroplating composition.

Claim 146. The method of claim 137 wherein the brightener concentration is at least about 6 mg per liter of the electroplating composition.

Claim 147. The method of claim 137 wherein the brightener concentration is at least about 8 mg per liter of the electroplating composition.

Claim 148. The method of claim 137 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

Claim 149. The method of claim 137 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

Claim 150. The method of claim 137 wherein the electroplating composition further comprises a suppressor agent.

Claim 151. The method of claim 150 wherein the suppressor agent is a polyether.

Claim 152. The method of claim 137 wherein the electroplating composition comprises a halide ion source.

Claim 153. The method of claim 137 wherein the microchip wafer substrate is electrically attached to a cathode of the system.

Claim 154. A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, electrolyte, suppressor agent, and one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition,

wherein the one or more brightener compounds comprise a group of the formula R'-S-R-SO<sub>3</sub>X where R is optionally substituted alkyl, optionally substituted heteroalkyl, optionally substituted aryl or optionally substituted heterocyclic; and X is a counter ion,

wherein one or more brightener compounds comprise bis-sulfonopropyl disulfide.

Claim 158. The method of claim 154 one or more brightener compounds have a molecular weight of about 1000 or less.

Claim 159. The method of claim 154 wherein the suppressor agent is a polyether.

Claim 160. A method for plating a semiconductor microchip wafer substrate, comprising:

electrolytically depositing copper onto a semiconductor microchip wafer substrate having microvias or trenches from an electroplating composition that comprises at least one soluble copper salt, an electrolyte, and one or more brightener compounds that comprise bis-

sulfonopropyl disulfide and the one or more brightener compounds present in a concentration of at least about 1.5 mg per liter of the electroplating composition.

Claim 161. The method of claim 160 wherein the brightener concentration is at least about 2 mg per liter of the electroplating composition.

Claim 162. The method of claim 160 wherein the brightener concentration is at least about 3 mg per liter of the electroplating composition.

Claim 163. The method of claim 160 wherein the brightener concentration is at least about 4 mg per liter of the electroplating composition.

Claim 164. The method of claim 160 wherein the brightener concentration is at least about 10 mg per liter of the electroplating composition.

Claim 165. The method of claim 160 wherein the brightener concentration is at least about 15 mg per liter of the electroplating composition.

Claim 166. The method of claim 160 wherein the electroplating composition further comprises a suppressor agent.

Claim 167. The method of claim 166 wherein the suppressor agent is a polyether.

**EVIDENCE APPENDIX B**

Docket No. 50439-2

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

RECEIVED  
CENTRAL FAX CENTER

APPLICANT: Barstad et al.

FEB 13 2004

SERIAL NO. 09/605,442

GROUP: 1741

FILED: June 28, 2000

EXAMINER: W. Nicholas

FOR: ELECTROLYTIC COPPER PLATING SOLUTIONS

**OFFICIAL**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

## DECLARATION UNDER 37 CFR 1.131

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Burstad et al.  
U.S.S.N. 09/605,442  
Page 2

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Date: 1-16-04

Leon R. Barstad  
Leon R. Barstad

Date: 1-16-04

James E. Rychwalski  
James E. Rychwalski

Date: 1-16-04

Mark Lefebvre  
Mark Lefebvre

Date: \_\_\_\_\_

Stephane Minard  
Stephane Minard

Barstad et al.  
U.S.S.N. 09/605,442  
Page 3

Date: \_\_\_\_\_

James L. Martin

Date: \_\_\_\_\_

Robert A. Schetty

Date: \_\_\_\_\_

Michael P. Toben

## Exhibit 1

Project: Kingshil 200m Bath Lift Test Notebook Number: 8111

Date	Time	TBA	MANUAL B-2 AD0	Auto R-2	Comments
	6:40 AM	4.36	50	AD0	800 m/s D.I.
				14.85	short off pump
	11:21	11:00	7		Turned on float pump
	12:30	12.25			(14.4)
	Lane Down	2:00			(25)
		3:00		44	AD0 800 m/s D.I.
	Lane Down				(20)
					(910)

	Time	TBA	MANUAL B-2 AD0	Auto B-2 AD0	Comments
	8:45				AD0 850 m/s D.I.
	8:50	3.0	60		
	9:10	12.9			

	Time	TBA	MANUAL B-2 AD0	Auto B-2 AD0	Comments
	6:05				AD0 900 m/s D.I.
	6:20	6.27	40		
	6:45	13.50			
	8:45	11:04	7		Auto done turn on Procedure 1000 float switch
	8:50	12:45			Powered 600 m/s 14.14

Signature

J. Barnd

Date

22

Read and Understood By:

Signature

Date

J. Barnd  
APRIL 3 2004 3:00 PM D.I.

## Exhibit 2

Project: Xerophylic bird Litter test Notebook Number: 31101000 water demand water lot #

Q 8111704 - 10 Processed at 8:40 AM

Q 8111704 - 11 "

Q 8111704 - 12 "

Q 8111704 - 13 "

Q 8111704 - 14 "

Q 8111704 - 15 "

B 8112319 - 16 "

B 8112319 - 15 "

B 8112319 - 14 "

B 8112319 - 13 "

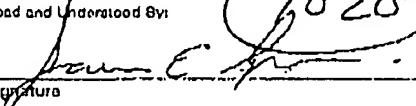
M 47133-23-F3 "

Date	Time	TBA	Manual B-2 mode	Auto B-2 mode	Comments
	9:40	12.7	20		(25)
	10:45	13.96			
	11:40	13.26			Dump off
	2100	11.00			(25)
	4:00	5/25. Down			(25) ADD 1830 mL D.E. rotated water bath

Read and Understood By:



Signature

  
6020

Date

Date

23

FEB-13-2004 FRI 02:23 PM EDWARDS & ANGELL  
Jan 20 04 07:04P JL Martin

FAX NO. 617 439 4170  
RECEIVED 516 486 0429  
CENTRAL FAX CENTER

P. 13  
P. 2

FER 13 2004  
OFI 13 2004

Docket No. 50439-2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Barstad et al.

SERIAL NO. 09/605,442 GROUP: 1741

FILED: June 28, 2000 EXAMINER: W. Nicholas

FOR: ELECTROLYTIC COPPER PLATING SOLUTIONS

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

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3. Attached as Exhibits 1 and 2 are true and accurate copies of laboratory notebook records (notebook pages 22 and 23 respectively), with dates deleted, of such actual work discussed in paragraph 2 above and completed prior to January 11, 1999. For instance, those Exhibits 1 and 2 disclose use of a copper electroplating composition identified as Nanoplate

FEB-13-2004 FRI 02:23 PM EDWARDS & ANGELL  
Jan 20 04 07:04P JL Martin

FAX NO. 617 439 4170  
516 486 0429

P. 14  
p. 3

Barstad et al.  
U.S.S.N. 09/605,442  
Page 2

2001, which is the same copper electroplating composition as disclosed in Example 2 on page 16 of the patent application. That Nanoplate 2001 electroplating composition contained a copper salt, an acidic electrolyte, a brightener of bis-sodium-sulfonopropyl-disulfide in an amount of 2.4 mg/liter, and a suppressor of propylene glycol copolymer. At Exhibit 2, copper electroplating of 1000 semiconductor wafers with the Nanoplate 2001 composition is reported. The designation of "Q" indicates test semiconductor wafers that contain trenches and the designation of "M" indicates test semiconductor wafers that contain microvias.

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Date: \_\_\_\_\_

Leon R. Barstad

Date: \_\_\_\_\_

James E. Rychwalski

Date: \_\_\_\_\_

Mark Lefebvre

Date: \_\_\_\_\_

Stephane Minard

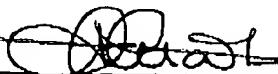
FEB-13-2004 FRI 02:23 PM EDWARDS & ANGELL  
Jan 20 04 07:04P JLMartin

FAX NO. 617 439 4170  
516 486 0429

P. 15  
p. 4

Burstad et al.  
U.S.S.N. 09/605,442  
Page 3

Date: Jan. 20, 2004

  
James L. Martin

Date: \_\_\_\_\_

  
Robert A. Schetty

Date: \_\_\_\_\_

  
Michael P. Toben

FEB-13-2004 FRI 02:23 PM EDWARDS & ANGELL  
Jan 20 04 07:04p JL Martin

FAX NO. 617 439 4170  
516 486 0429

P. 16  
P. 5

Exhibit 1

Project: Completed 20m Bath Lift Test

Notebook Number: 3116

Date	Time	TBA	Normal B-2 AD0	Aero B-2 AD0	Comments
	6:45AM	4:36	50		AD0 600 ml D.I.
		14:45			shot off prop
	11:21	11:00	7		Turned on prop pump
	12:30	12:25			H-1
Lift Down	2:00				(25)
	3:00			44	(20)
Lift Down					AD0 900 ml D.I.
					(910)
Date	Time	TBA	Normal B-2 AD0	Aero B-2 AD0	Comments
	8:45				AD0 850 ml D.I.
	8:50	3.0	60		
	9:10	12.9			
					(80)
					(920)
Date	Time	TBA	Normal B-2 AD0	Aero B-2 AD0	Comments
	6:05				D.I. 900 ml D.I.
	6:20	6:27	40		
	6:45	13:53			
	8:45	11:04	7		Propeller 1000 turns on fast
	8:50	12:45			Propeller 600 ml batch
<i>J. Barnd</i>					Read and Understood By: <i>J. Barnd</i>
Signature					Date _____
Date					
22					
					Date _____

FEB-13-2004 FRI 02:23 PM EDWARDS & ANGELL  
Jan 20 04 07:05P JL Martin

FAX NO. 617 439 4170  
516 486 0429

P. 17  
P. 6

reloc Xanthol/2001 backlit test Exhibit 2  
Notebook Number: 3110

1000 water forward water 1st + 40

Q 8111704 - 10

Proceed at 11:45 AM

Q 8111704 - 11

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Q 8111704 - 12

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Q 8111704 - 13

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Q 8111704 - 14

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Q 8114704 - 15

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B 8112319 - 16

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B 8112319 - 15

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B 8112319 - 14

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B 8112319 - 13

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~~ME~~ M 417133-23-F3

Date	Tide	TBA	Manual	Auto	Comments
9:40	12.7	20			25
10:45	12.96				
11:40	12.26				
12:00	11.00				
4:00	5.1/2 down				Drop off 25 25 25 ADD 18MM D.E. for water in front

Signature

J. Martin

Read and Understood By:

Signature

Date

6/20

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FEB-13-2004 FRI 02:24 PM EDWARDS & ANGELL  
JJAN. 16. 2004F 3:05PM5 AM SHIPLEY RONALNGELL, LLP

FAX NO. 617 439 4170  
FAX NO. 508 485 03NO. 400

P. 18  
P. 2<sup>o</sup> U2

Docket No. 50439-2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

RECEIVED  
CENTRAL FAX CENTER

APPLICANT: Barstad et al.

FEB 13 2004

SERIAL NO. 09/605,442

GROUP: 1741

FILED: June 28, 2000

EXAMINER: W. Nicholas

FOR: ELECTROLYTIC COPPER PLATING SOLUTIONS

OFFICIAL

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

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FEB-13-2004 FRI 02:24 PM EDWARDS & ANGELL  
JAN. 16, 2004 F 3:05PM5 AM SHIPLEY RONALNGELL, LLP

FAX NO. 617 439 4170 P. 19  
FAX NO. 608 485 US1NO. 400 P. 3' US

Barstad et al.  
U.S.S.N. 09/605,442  
Page 2

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Date: \_\_\_\_\_

James E. Rychwalski

Date: \_\_\_\_\_

Mark Lefebvre

Date: \_\_\_\_\_

Stephanie Minard

FEB-13-2004 FRI 02:24 PM EDWARDS & ANGELL  
JAN. 16. 2004 F 3:05PM5 AM SHIPLEY RONALNGELL, LLP

FAX NO. 617 439 4170 P. 20  
FAX NO. 508 485 03 NO. 400 P. 4P. 04

Barstad et al.  
U.S.S.N. 09/605,442  
Page 3

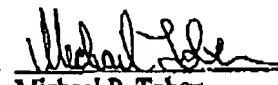
Date: \_\_\_\_\_

James L. Martin

Date: \_\_\_\_\_

Robert A. Scheitly

Date: 1/16/04

  
Michael P. Toben

FEB-13-2004 FRI 02:24 PM EDWARDS & ANGELL  
JAN. 16, 2004 3:05PM AM SHIPLEY RONALD GELL, LLP

FAX NO. 617 439 4170  
FAX NO. 508 485 03t NO. 400 P. 21  
P. 50 00

Exhibit 1

Project: Waughlet 2000 Bulk Lift Test Notebook Number: 3.111

Date	Time	TBA	Manual	Auto	Comments
			B-2 000	B-2 000	
	6:50 AM	4:36	50		MWD 800 ml D.I.
		14:05			shot off pump
	11:25	11:00	7		Turned on pump
	12:30	12:25			44
	Leave Down	2:00			25
		3:00			20
	Lane Down				Arrived 900 ml D.I.
					970

Date	Time	TBA	Manual	Auto	Comments
			B-2 000	B-2 000	
	8:45				MWD 850 ml D.I.
	8:50	3.0	60		
	9:10	12.9			80

Date	Time	TBA	Manual	Auto	Comments
			B-2 000	B-2 000	
	6:05				MWD 900 ml D.I.
	6:20	6:27	40		
	6:45	13:53			
	8:45	11:04	7		Flow rate 1000 Turned on Boring 600 ml
	8:50	12:45			60:14 Actual 570 ml Start 30 ml D.I.

Signature

Tom Barrett

Signature

Date

22

FEB-13-2004 FRI 02:24 PM EDWARDS & ANGELL  
JJAN. 16. 2004F 3:06PM5 AM SHIPLEY RONALNGELL, LLP

FAX NO. 617 439 4170  
FAX NO. 508 485 0310 NO. 400 P. 22  
P. 6. 00

Project XShapley/2001 back lift test Babette 2 Notebook Number: 3110

1000 water power meter Int'l

Q 8111704 - 10

Prepared at 8:35 AM

Q 8111704 - 11

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Q 8111704 - 12

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Q 8111704 - 13

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Q 8111704 - 14

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Q 8111704 - 15

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B 8112319 - 16

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B 8112319 - 15

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R 8112319 - 14

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B 8112315 - 13

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~~X~~ M 47133-23 - E3

Date Time TBA <sup>(Mon)</sup> B-2 auto <sup>Auto</sup> B-2 v.v. Comment  
25

9:40 13.7 20

10:45 13.96

11:40 13.26

12:00 11.00

4:00 51.05 Down

Ampl off

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Read and Understood By:

Signature

Date

Date

FEB-13-2004 FRI 02:25 PM EDWARDS &amp; ANGELL

FAX NO. 617 439 4170

P. 23

JAN-16-2004 THU 07:57 PM EDWARDS &amp; ANGELL, LLP FAX NO. 508 485 0383

P. 02

Docket No. 50439-2

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Barslak et al.		
SERIAL NO.:	09/603,442	GROUP:	1741
FILED:	June 28, 2000	EXAMINER:	W. Nichols
FOR:	ELECTROLYTIC COPPER PLATING SOLUTIONS		

Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, VA 22313-1450

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FEB-13-2004 FRI 02:25 PM EDWARDS &amp; ANGELL

FAX NO. 617 439 4170

P. 24

JAN-15-2004 THU 07:57 PM EDWARDS &amp; ANGELL, LLP FAX NO. 508 485 0383

P. 03

Barslind et al.  
U.S.811N. 09/605,442  
Page 1

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Date: \_\_\_\_\_

Leon R. Barslind

Date: \_\_\_\_\_

James T. Rychwalski

Date: \_\_\_\_\_

Mark Lefebvre

Date: 01/16/2004

Samuel M. Ward

FEB-13-2004 FRI 02:25 PM EDWARDS & ANGELL

FAX NO. 617 439 4170

P. 25

JAN-15-2004 THU 07:58 PM

EDWARDS & ANGELL, LLP

FAX NO. 508 485 0383

P. 04

Borchard et al.  
U.S.P.N. 09/605,442  
Page 3

Date: \_\_\_\_\_

James L. Martin

Date: \_\_\_\_\_

Robert A. Schoty

Date: \_\_\_\_\_

Michael P. Toben

FEB-13-2004 FRI 02:25 PM EDWARDS &amp; ANGELL

FAX NO. 617 439 4170

P. 26

JAN-15-2004 THU 07:58 PM	EDWARDS & ANGELL, LLP	FAX NO. 508 485 0383	P. 05
Exhibit 1			
Project: <u>1/15/04 2004 Bell Tech</u>			Notebook Number: <u>PL11</u>
Detail Times <u>7:45 AM</u> <u>10-2-0402</u> <u>AM</u>	<u>14:45</u> <u>4:45</u> <u>5:00</u>	<u>14:00</u> <u>14:00</u>	<u>AM 600 mls</u> <u>D.F.</u>
	<u>14:05</u>		<u>Short stop here</u>
	<u>14:15</u> <u>11:00</u> <u>7</u>		<u>Turned on fuel gauge</u>
	<u>14:20</u> <u>12:25</u>		<u>14:45</u> <u>25</u>
Lunch Done <u>2:00</u>	<u>3:00</u>	<u>4:45</u>	<u>AM 600 mls</u> <u>D.F.</u> <u>(25)</u>
Lunch Done			<u>9:10</u>
Time <u>7:45 AM</u> <u>10-2-0402</u> <u>AM</u>	<u>14:45</u> <u>3:0</u> <u>6:0</u>	<u>14:00</u> <u>8:30 mls D.F.</u>	<u>AM 600 mls D.F.</u>
	<u>8:50</u> <u>12:45</u>		<u>14:45</u> <u>10</u>
			<u>AM 600 mls D.F.</u> <u>(10)</u>
Time <u>7:45 AM</u> <u>10-2-0402</u> <u>AM</u>	<u>14:45</u> <u>6:27</u> <u>4:0</u>	<u>14:00</u> <u>9:00 mls D.F.</u>	<u>AM 600 mls D.F.</u>
	<u>6:45</u>		
	<u>8:45</u> <u>11:04</u> <u>7</u>	<u>14:00</u> <u>Turned on</u>	<u>Propane 70000</u>
	<u>9:50</u> <u>12:45</u>	<u>14:00</u> <u>fuel water</u>	<u>Propane 600 mls</u>
<u>S. Baird</u>			<u>6:15 AM</u>
Signature		Signature	<u>AM 600 mls D.F.</u>
Date		Date	
22			

FEB-13-2004 FRI 02:25 PM EDWARDS &amp; ANGELL

FAX NO. 617 439 4170

P. 27

JAN-15-2004 THU 07:58 PM

EDWARDS &amp; ANGELL, LLP

FAX NO. 508 485 0383

P. 08

10/00

Xchange 1200 Land Litigant

Exhibit A

Notebook Number: 3110

10/20 water general water litig

G	9111704 - 10	Present at 11:00 AM
N	9111704 - 11	"
R	9111704 - 12	"
A	9111704 - 13	"
A	9111704 - 14	"
A	9111704 - 15	"
B	9112319 - 16	"
D	9112319 - 15	"
B	9112319 - 14	"
B	9112319 - 13	"
M	9112319 - 12	"
M	9112319 - 11	"

Date	Time	Item	Rate	Comments
	TBA	10:00 AM	10:00 AM	25
9:40	12.7	20		
10:45	13.96			25
10:40	12.26			
2:00	16.00			
4:00	5/loc/Down			25 Add 1/2 hour D.T. return trip

Signature

Date

Handed Over/Received By

Signature

Date

Docket No. 50439-2

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Barstad et al.

RECEIVED  
CENTRAL FAX CENTER

SERIAL NO.: 09/605,442

EXAMINER: W. Nicholas

FEB 13 2004

FILED: June 28, 2000

GROUP: 1742

C O P Y C E N T E R

FOR: ELECTROLYTIC COPPER PLATING SOLUTIONS

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

## DECLARATION

I, Peter Corless, declare as follows:

1. I am an attorney of record of the above-identified application ("the application"), which has been assigned by all the inventors to the Shipley Company, L.L.C. A copy of the executed Assignment for the application is attached.

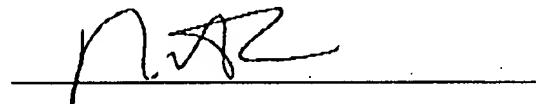
2. Named inventor Robert Schetty is no longer employed by the Shipley Company. I sent by Federal Express to the last known residence address of Robert Schetty a Declaration under 37 CFR 1.131 for the application for Robert Schetty's review and signature. That overnight mail included an envelope with postage pre-paid for the signed Declaration to be returned to me by overnight service. That correspondence to Robert Schetty was returned to me by Federal Express as being undeliverable.

3. Previously, in patent application number 09/957,218 also assigned to Shipley Company and having Robert Schetty as a named inventor, Robert Schetty refused to sign a Declaration under 37 CFR 1.63. An attorney of record in that case filed a petition (which was granted) to accept the Declaration under 37 CFR 1.63 without Robert Schetty's signature.

Barstad et al.  
U.S.S.N. 09/605,442  
Page 2

4. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful and false statements and the like so made are punishable by fine or imprisonment, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issued thereon.

Date: February 15, 2004



Peter F. Corless

Attorney Docket No. 50439-2  
Page 1 of 2

ASSIGNMENT

WHEREAS, I, Leon R. Barstad of Raynham, Massachusetts, I, James E. Rychwalski of Medway, Massachusetts, I, Mark Lefebvre of Hudson, New Hampshire, I, Stephane Menard of , I, James L. Martin of Merrick, New York, I, Robert A. Scheit, III of Fort Salonga, New York and I, Michael P. Toben of Smithtown, New York, (hereinafter referred to as "Assignors"), have invented certain new and useful improvements in "ELECTROLYTIC COPPER PLATING SOLUTIONS", for which an application for United States Letters Patent was filed on June 28, 2000 and assigned U.S. Serial No. 09/605,442 which application claims priority of U.S. Serial No. 09/313,045., filed May 17, 1999, and

WHEREAS, Shipley Company, L.L.C., located at 455 Forest Street, Marlborough, Massachusetts 01752, (hereinafter referred to as the "Assignee"), is desirous of acquiring the entire right, title and interest in and to the same invention, and in and to the said application, and any Letters Patent that may issue thereon;

NOW, THEREFORE, TO ALL WHOM IT MAY CONCERN, be it known that for the above consideration, the Assignors have assigned and transferred, and do hereby assign and transfer to the Assignee, its successors and assigns, their entire right, title and interest for the United States in and to the said invention and in and to the said application and all patents which may be granted therefor, and all divisions, reissues, substitutions, continuations, in whole or in part, re-examinations, and extensions thereof, and all applications claiming priority therefrom; and the Assignors hereby authorize and request the Commissioner of Patents and Trademarks to issue all patents for said invention, or patents resulting therefrom, insofar as their interest is concerned, to the Assignee; to have and to hold for the sole and exclusive use and benefit of the Assignee, its successors and assigns, to the full end of the term or terms for which any and all of said Letters Patent for said invention may issue, to the same extent as the Assignors would hold and enjoy if this Assignment had not been made.

The Assignors also have assigned and transferred, and do hereby assign and transfer to the Assignee, its successors and assigns, their entire right, title and interest in and to the invention disclosed in said application, in all countries of the world foreign to the United States, including the right to file applications and obtain patents for said invention in its own name in said countries and including all rights of priority in said countries under the terms of any applicable international convention; to have and to hold for the sole and exclusive use and benefit of the Assignee, its successors and assigns, to the full end of the term or terms for which any and all of said Letters Patent for said invention may issue, to the same extent as the Assignors would hold and enjoy if this Assignment had not been made.

The Assignors further agree to execute any and all patent applications, assignments, affidavits, and any other papers in connection therewith necessary to perfect such patent rights, and also agree, at the request of the Assignee, to testify in any legal proceedings, sign all lawful papers, make all lawful oaths, and generally do everything possible to aid said Assignee, its successors and assigns, to obtain, maintain and enforce patent protection for said invention in all countries.

Docket No. 50439-2  
Page 2 of 2

The Assignors also hereby grant the law firm of EDWARDS & ANGELL, LLP, Dick, Bronstein, Roberts & Cushman, IP Group, the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this document.

IN WITNESS WHEREOF, the Assignors have caused this Assignment to be executed.

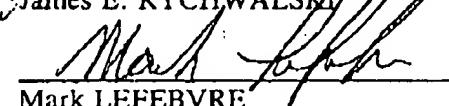
Dated this 13 day of March, 2001.

  
Leon R. BARSTAD

Dated this 15 day of March, 2001.

  
James E. RYCHWALSKI

Dated this 15 day of March, 2001.

  
Mark LEFEBVRE

Dated this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

Stephane MENARD

Dated this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

James L. MARTIN

Dated this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

Robert A. SCHETTY, III

Dated this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

Michael TOBEN

FEB-13-2004 FRI 02:27 PM EDWARDS & ANGELL

FAX NO. 617 439 4170

P. 33

APR 27 01 04:33P Rob Schetty

631-269-0132

P. 7

APR-27-2001 FRI 03:38 AM EDWARDS & ANGELL, LLP

FAX NO. 508 0383

P. 07

Attorney Docket No. 5D439-2

Page 1 of 2

ASSIGNMENT

WHEREAS, I, Leon R. Barstad of Raynham, Massachusetts, I, James E. Rychwalski of Medway, Massachusetts, I, Mark Lefebvre of Hudson, New Hampshire, I, Stephane Menard of , I, James L. Martin of Merrick, New York, I, Robert A. Schetty, III of Port Salonga, New York and I, Michael P. Toben of Smithtown, New York, (hereinafter referred to as "Assignors"), have invented certain new and useful improvements in "ELECTROLYTIC COPPER PLATING SOLUTIONS", for which an application for United States Letters Patent was filed on June 28, 2000 and assigned U.S. Serial No. 09/605,442 which application claims priority of U.S. Serial No. 09/313,045, , filed May 17, 1999, and

WHEREAS, Shipley Company, L.L.C., located at 455 Forest Street, Marlborough, Massachusetts 01752, (hereinafter referred to as the "Assignee"), is desirous of acquiring the entire right, title and interest in and to the same invention, and in and to the said application, and any Letters Patent that may issue thereon;

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The Assignors also have assigned and transferred, and do hereby assign and transfer to the Assignee, its successors and assigns, their entire right, title and interest in and to the invention disclosed in said application, in all countries of the world foreign to the United States, including the right to file applications and obtain patents for said invention in its own name in said countries and including all rights of priority in said countries under the terms of any applicable international convention; to have and to hold for the sole and exclusive use and benefit of the Assignee, its successors and assigns, to the full end of the term or terms for which any and all of said Letters Patent for said invention may issue, to the same extent as the Assignors would hold and enjoy if this Assignment had not been made.

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FEB-13-2004 FRI 02:27 PM EDWARDS & ANGELL

FAX NO. 617 439 4170

P. 34

APR 27 01 04:33P Rob Schetty

631-269-0132

p. 8

APR-27-2001 FRI 03:38 AM EDWARDS & ANGELL, LLP

FAX NO. 508 0363

P. 08

Docket No. 50439-2

Page 2 of 2

The Assignors also hereby grant the law firm of EDWARDS & ANGELL, LLP, Dike, Bronstein, Roberts & Cushman, IP Group, the power to insert on this Assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this document.

IN WITNESS WHEREOF, the Assignors have caused this Assignment to be executed.

Dated this \_\_\_\_ day of \_\_\_\_\_,

Leon R. BARSTAD

Dated this \_\_\_\_ day of \_\_\_\_\_,

James E. RYCHWALSKI

Dated this \_\_\_\_ day of \_\_\_\_\_,

Mark LEFEBVRE

Dated this \_\_\_\_ day of \_\_\_\_\_,

Stephane MENARD

Dated this 25 day of April, 2001

James I. MARTIN

Dated this \_\_\_\_ day of \_\_\_\_\_,

Robert A. SCHETTY, III

Michael TOBEN

FEB-13-2004 FRI 02:28 PM EDWARDS & ANGELL

FAX NO. 617 439 4170

P. 35

23 Apr 01 16:41

S. MENARD - M.P.C.

(33) 437 280 425

P. 6

Attorney Docket No. 50439-2  
Page 1 of 2

ASSIGNMENT

WHEREAS, I, Leon R. Barstad of Raynham, Massachusetts, I, James E. Rychwalski of Medway, Massachusetts, I, Mark Lefebvre of Hudson, New Hampshire, I, Stephane Menard of , I, James L. Martin of Merrick, New York, I, Robert A. Schetty, III of Fort Salonga, New York and I, Michael P. Toben of Smithtown, New York, (hereinafter referred to as "Assignors"), have invented certain new and useful improvements in "ELECTROLYTIC COPPER PLATING SOLUTIONS", for which an application for United States Letters Patent was filed on June 28, 2000 and assigned U.S. Serial No. 09/605,442 which application claims priority of U.S. Serial No. 09/313,045, , filed May 17, 1999, and

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FEB-13-2004 FRI 02:28 PM EDWARDS & ANGELL

23 APR 01 16:41

S. MENARD - M.P.C.

FAX NO. 617 439 4170

(33) 437 280 425

P. 36

p.7

Docket No. 50439-2  
Page 2 of 2

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Leon R. BARSTAD

Dated this \_\_\_\_\_ day of \_\_\_\_\_,

James E. RYCHWALSKI

Dated this \_\_\_\_\_ day of \_\_\_\_\_,

Mark LEFEBVRE

Dated this 23<sup>rd</sup> day of April, 2001.

~~Stephane MENARD~~

Dated this \_\_\_\_\_ day of \_\_\_\_\_,

James L. MARTIN

Dated this \_\_\_\_\_ day of \_\_\_\_\_,

Robert A. SCHETTY, III

Dated this \_\_\_\_\_ day of \_\_\_\_\_,

Michael TOBEN

FEB-13-2004 FRI 02:28 PM EDWARDS & ANGELL

FAX NO. 617 439 4170

P. 37

APR. 19. 2001 11:33PM:26 [SHIPLEY RONALD ANGELL, LLP

NO. 346

P. 7

FAX NO. 784850363

P. 07

Attorney Docket No. 50439-2

Page 1 of 2

ASSIGNMENT

WHEREAS, I, Leon R. Barstad of Raynham, Massachusetts, I, James E. Rychwalski of Medway, Massachusetts, I, Mark Lefebvre of Hudson, New Hampshire, I, Stephane Menard of I, James L. Martin of Merrick, New York, I, Robert A. Schetty, III of Port Salonga, New York and I, Michael P. Toben of Smithtown, New York, (hereinafter referred to as "Assignors"), have invented certain new and useful improvements in "ELECTROLYTIC COPPER PLATING SOLUTIONS", for which an application for United States Letters Patent was filed on June 28, 2000 and assigned U.S. Serial No. 09/605,442 which application claims priority of U.S. Serial No. 09/313,045, filed May 17, 1999, and

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FEB-13-2004 FRI 02:29 PM EDWARDS & ANGELL

FAX NO. 617 439 4170

P. 38

AAPR. 19. 2001W 2:30PM7 PM SHIPLEY RONALNGELL, LLP

FAX NO. 508 485 031NO. 349

P. 2<sup>o</sup> US

Docket No. 50439-2

Page 2 of 2

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Dated this \_\_\_\_\_ day of \_\_\_\_\_.

Leon R. BARSTAD

Dated this \_\_\_\_\_ day of \_\_\_\_\_.

James E. RYCHWALSKI

Dated this \_\_\_\_\_ day of \_\_\_\_\_.

Mark LEFEBVRE

Dated this \_\_\_\_\_ day of \_\_\_\_\_.

Stephane MENARD

Dated this 19 day of April , 2001.

James L. MARTIN

Dated this \_\_\_\_\_ day of \_\_\_\_\_.

Robert A. SCHETTY, III

Dated this 19 day of April , 2001.

Michael TOBEN